

### **REMARKS**

The Office Action dated November 17, 2004 has been carefully considered. Claims 1 and 4 are currently amended and claims 2 and 5 are cancelled. Claims 1, 3-4, and 6-7 are currently pending.

### **35 USC §103 Rejections**

Pending claims 1, 3-4, and 6-7 stand rejected as obvious under 35 USC §103(a) as being unpatentable over U.S. Patent No. 4,873,368 to Kadowaki ("Kadowaki"). Claims 1 and 4 are currently amended to recite mass flow rate parameters for the introduction of absorbent water into the acrylic acid absorption column in relation to the mass flow rate of propylene introduced into said first reaction zone.

The claims as currently amended further advance the objects of the invention and further distinguishes over Kadowaki by reciting the range for the mass flow rate ratio of absorbent water to propylene. One of the objects of the present invention is to prevent acrylic acid polymerization at subsequent process steps in acrylic acid production. Performing the method as currently claimed, and specifically introducing the absorbent water into the acrylic acid absorption column at a mass flow rate in the range of 0.1 to 1.5 times the mass flow rate of propylene introduced into said first reaction zone, further achieves this object.

Kadowaki does not contemplate the effect this parameter has on the overall performance of the process. Yet, if the mass flow rate of the absorbent falls short of 0.1 times, the shortage will result in rendering the absorption of acrylic acid difficult, decreasing the quantity of the wetting liquid in the absorption column, and inducing an extreme decline in the efficiency of the operation of the absorption column. Alternatively, if the mass flow rate exceeds 1.5 times, the excess will result in increasing the water concentration of the acrylic acid-containing solution, which is subjected to absorption of acrylic acid. See Specification, page 19, lines 11 to 28. "Acrylic acid-containing solution absorbed in said acrylic acid absorption column having a water concentration in the range of 1 – 45 wt. %" means an acrylic acid concentration of 55 to 99 wt. %. The acrylic acid concentration of about 45 to 50 wt. % of the acrylic acid containing water

based solution is the easiest polymerizable condition in the purification process, such as the distillation column. However in Kadowaki, this range is not disclosed.

As stated in the specification of the present invention, “By effecting this control in a more specific section of the range of 1 – 45 wt. %, it is made possible to narrow the width of control of the distillation conditions at the subsequent steps, restrain the fluctuations of loss of acrylic acid in the absorption column and a waste water generated from the process respectively to the minimum, and secure the stability of operation at the subsequent steps including the equipment for the treatment of the waste water.” See Specification, page 4, line 28 to page 5, line 3.

An important aspect of the present invention is the relationship between acrylic acid loss in the absorption column and prevention of acrylic acid polymerization. Acrylic acid can be discharged from the top of the absorption column, and when it is it causes acrylic acid loss in the absorption column. If the absorption efficiency is improved by adjusting a mass flow rate in the range of 0.1 to 1.5 times, the amount of acrylic acid reaching the top of the absorption column is decreased. This decrease can lead to prevention of acrylic acid polymerization.

Additionally, the Applicant reasserts that the previous amendment reciting that the first and second reaction zones are formed in a single reactor is not disclosed or suggested by Kadowski. The Office Action does not provide any citation in Kadowski that discloses this feature. In fact, the Office Action fails to even recite this feature in describing the steps of the claims. See page 3 of the Office Action. However, the differences between a single reactor and two reactors are critical to the function of the method.

In claim 1, acrylic acid concentration in an absorption column is defined as “said acrylic acid-containing solution obtained in said acrylic acid absorption column having a water concentration in the range of 1 to 45 wt. %”. As mentioned above, a water concentration in the range of 1 – 45 wt. % equals an acrylic acid concentration of 55 to 99 wt. %. This is defined as the water concentration because the amount of water which is introduced into a reactor or absorption column, discharged from the top of an absorption column, or recycled in the reactor gives an effect to the acrylic acid concentration in the absorption column. The water introduced into a

single reactor is reached to an absorption column and can act as an absorbent.

In a single reactor, steam and oxygen are only introduced thereto from inlet port of the reactor, but in two reactors, steam and oxygen can be introduced from each inlet port. Therefore, a system using two reactors is liable to introduce large amounts of water to an absorption column. This difference is illustrated in Example 10 of Kadowaki, total amount of water introduced 1<sup>st</sup> reactor and 2<sup>nd</sup> reactor reaches up to 20.9 wt. %, which does not overlap with the range of claim 1.

As previously indicated, FIGS. 1 and 2 of Kadowski represent only the first stage reaction apparatus. Kadowski does indicate that the second-stage reactor can be of any construction and structure suitable for and capable of receiving the gases formed in the first stage apparatus after air and steam have been added. See Kadowski at col. 10, lines 61-65. This description does not however contemplate both reaction zones being formed in a single reactor as currently claimed.

One of ordinary skill in the art would have no reasonable expectation of success to form both reaction zones in a single reactor as it is not suggested by Kadowski. The Examples in Kadowski all provide separate reactors for carrying out each stage of the reaction. It is respectfully suggested that the rejection relies on hindsight, which is impermissible, by viewing Kadowski from the perspective of the current invention. Removal of the rejection is requested.

### **Double Patenting**

Pending claims 1, 3-4, and 6-7 stand provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over co-pending application No. 10/632,762 in view of Kadowski. For the reasons discussed above with reference to Kadowski, the Applicant respectfully contends that the claims are not obvious. In particular, recited limitation that the first reaction zone and second reaction zone are formed in a single reactor is not obvious. Like Kadowski, the co-pending application uses individual reactors for each stage reaction.

In view of the foregoing, Applicants submit that all pending claims are in condition for allowance and request that all claims be allowed. The Examiner is invited to contact the

undersigned should he believe that this would expedite prosecution of this application. It is believed that no fee is required. The Commissioner is authorized to charge any deficiency or credit any overpayment to Deposit Account No. 13-2165.

Respectfully submitted,

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A handwritten signature in black ink, appearing to read 'Christopher S. Casieri', is written over a horizontal line.

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